PROGRAMME AND ABSTRACTS

7th International Conference on

Computational and Financial Econometrics (CFE 2013)

http://www.cfenetwork.org/CFE2013

and

6th International Conference of the
ERCIM (European Research Consortium for Informatics and Mathematics) Working Group on

Computational and Methodological Statistics (ERCIM 2013)

http://www.cmstatistics.org/ERCIM2013

Senate House, University of London, UK
14-16 December 2013

ERCIM
European Research Consortium for Informatics and Mathematics

ERCIM WG on Computational and Methodological Statistics
http://www.CMStatistics.org

Computational and Financial Econometrics
http://www.CFEnetwork.org

Queen Mary University of London
http://www.qmul.ac.uk

Birkbeck University of London
http://www.bbk.ac.uk

LSE The London School of Economics and Political Science
http://www.lse.ac.uk

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ES131 Room B29 CONTRIBUTIONS TO OPTIMAL DESIGNS **Chair: Alexander Donev**

E970: **Optimal experimental designs for nonlinear analysis: Solving the conundrum**

Presenter: **Jose M Vidal-Sanz**, Universidad Carlos III de Madrid, Spain

Co-authors: Mercedes Esteban-Bravo, Agata Leszkiewicz

To reduce the experimental cost and respondents' fatigue, optimal experimental designs maximize the information elicited from the respondent, or equivalently minimize the estimator variance. However, in many models the variance depends on the unknown regression parameters β. Therefore we cannot optimally design the experiment because its efficiency depends on parameters to be estimated from the data. Previous literature dealt with this puzzle by imposing assumptions on the unknown parameters: (1) choosing an arbitrary vector of parameters β supposedly applying 'prior knowledge'; or (2) postulating a probability distribution for β over the parametric space hopefully concentrated around the true value. Therefore, the design is efficient only if these assumptions are correct. Little is known about the robustness of the design, when the true parameters deviate from the assumed values. Moreover, if we knew the value of true parameters, there would be no reason to do the experiment in the first place. We propose a general approach to compute optimal conjoint designs in problems in which the covariance matrix depends on the unknown parameter. We solve this problem using efficient computational methods for robust optimization, and provide numerical examples for discrete-choice experiments comparing our approach and the classical methods.

E1180: **Approximate Bayesian adaptive optimal design for computer experiments**

Presenter: **Noha Youssef**, American University in Cairo, Egypt

It is very common to model the computer experiment output using a Gaussian process model. The Gaussian process model consists of two parts; a fixed part (the mean) and a random part. If the hierarchical structure is used with the Gaussian process model then a hyperprior distribution is assigned for the hyperparameters of the prior distribution of the mean parameters. The Wishart distribution is a suitable prior distribution for the covariance hyperparameters of the mean parameters however computing the posterior distribution is not tractable. In addition, sequentially selecting an optimal design such as the maximum entropy sampling design relies on obtaining the predictive distribution for the model output at every single step. Two alternatives are proposed here to tackle the intractability problem for both the posterior and the predictive distributions. The first is to create an approximate criterion that does not depend directly on the predictive distribution and the second is to choose a good approximation method such as the Approximate Bayesian Computation method to approximate the posterior and the predictive distributions.

E1241: **Optimal design for correlated processes with input-dependent noise**

Presenter: **Alexis Boukouvalas**, Aston University, United Kingdom

Co-authors: Dan Cornford, Milan Stehlik

Optimal design for parameter estimation in Gaussian process regression models with input-dependent noise is examined. The motivation stems from the area of computer experiments, where computationally demanding simulators are approximated using Gaussian process emulators to act as statistical surrogates. In the case of stochastic simulators, which produce a random output for a given set of model inputs, repeated evaluations are useful, supporting the use of replicate observations in the experimental design. The findings are also applicable to the wider context of experimental design for Gaussian process regression and kriging. Designs are proposed with the aim of minimising the variance of the Gaussian process parameter estimates. A heteroscedastic Gaussian process model is presented which allows for an experimental design technique based on an extension of Fisher information to heteroscedastic models. It is empirically shown that the error of the approximation of the parameter variance by the inverse of the Fisher information is reduced as the number of replicated points is increased. Through a series of simulation experiments on both synthetic data and a systems biology stochastic simulator, optimal designs with replicate observations are shown to outperform space-filling designs both with and without replicate observations. Guidance is provided on best practice for optimal experimental design for stochastic response models.

E977: **Maximin efficient designs for estimating the interesting part of a dose-effect curve**

Presenter: **Frank Miller**, Stockholm University, Sweden

Co-authors: Ellinor Fackle Fornius, Hans Nyquist

As the costs of clinical studies increase, the demand for more efficient designs also increases. Therefore, there is a growing interest in introducing designs that optimize precision in clinical studies. Unfortunately, optimal designs generally require knowledge of unknown parameters. We consider the maximin approach to handle this problem. A maximin efficient design maximizes the efficiency when compared to a standard design, as the parameters vary in a specified subset of the parameter space. Maximin efficient designs have shown to be numerically difficult to construct. However, a new algorithm, the H-algorithm, considerably simplifies the construction of these designs. We exemplify the maximin efficient approach by considering an Emax-sigmoid model describing a dose-response relationship and compare inferential precision with that obtained when using a uniform design. In a first approach to construct a maximin efficient design we specify a number of possible scenarios, each of which describing a possible shape of the dose-response relation. The design obtained is shown to be at least 15 percent more efficient than the uniform design. It is then shown that the obtained design is maximin efficient also for a much larger parameter set defined by parameter values between those specified by the initial scenarios.